

EXHIBIT C

UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF MICHIGAN
SOUTHERN DIVISION

IMRA AMERICA, INC., a Michigan
corporation,

Case No. : 2:06-cv-15139

Plaintiff,

Judge: Hon. Anna Diggs Taylor

v.

Magistrate: Hon. Mona K. Majzoub

IPG PHOTONICS CORPORATION, a
Delaware corporation

Defendant.

Edward H. Pappas (P23224)
epappas@dickinsonwright.com
John A. Artz (P24679)
jaartz@dickinsonwright.com
Dickinson Wright PLLC
38525 Woodward Avenue, Suite 2000
Bloomfield Hills, MI 48304-2970
Telephone: (248) 433-7200
Facsimile: (248) 433-7274

Robert G. Krupka
bob.krupka@kirkland.com
Kirkland & Ellis LLP
777 South Figueroa Street
Los Angeles, CA 90017-5800
Telephone: 213-680-8400
Facsimile: 213-680-8500

Craig S. Summers
craig.summers@kmob.com
Amy C. Chun
amy.chun@kmob.com
Knobbe, Martens, Olson & Bear, LLP
2040 Main Street, 14th Floor
Irvine, CA 92614
Telephone: (949) 760-0404
Facsimile: (949) 760-9502

Attorneys for Plaintiff
IMRA AMERICA, INC.

Barbara L. Mandell (P36437)
bmandell@comcast.net
Kohn & Associates, PLLC
30500 Northwestern Highway, Suite 410
Farmington Hills, MI 48334-3179
Telephone: (248) 539-5050
Facsimile: (248) 539-5055

Kurt L. Glitzenstein
glitzenstein@fr.com
Fish & Richardson P.C.
225 Franklin Street
Boston, MA 02110
Telephone: 617-542-5070
Facsimile: 617-542-8906

Attorneys for Defendant
IPG PHOTONICS CORPORATION

**DECLARATION OF DR. WAYNE H. KNOX IN SUPPORT OF IMRA
AMERICA'S BRIEF ON CLAIM CONSTRUCTION**

I, Wayne H. Knox, hereby declare as follows:

1. I am the Director of The Institute of Optics at the University of Rochester, where I am also a Professor of Optics and Professor of Physics. I submit this declaration on behalf of Plaintiff/Counterdefendant IMRA America, Inc. ("IMRA") in the above-referenced action. Unless otherwise stated, the facts set forth in this declaration are true of my own personal knowledge, and, if called upon to do so, I could and would testify competently to them.

2. I attended The Institute of Optics, University of Rochester in Rochester, New York, from which I received a B.S. degree in 1979 and a Ph.D. degree in 1984.

3. Beginning in 1984, I was employed as a Postdoctoral Fellow at Bell Labs in Holmdel, New Jersey. In 1985, I was promoted to Member of Technical Staff. In 1990, I was promoted to Distinguished Member of Technical Staff. In 1997, I was promoted to Director of the Advanced Photonics Research Department, where I was responsible for forward-looking research in a number of areas related to advanced technologies in telecommunications in long-haul, access and Metro networks. In 2001, I returned to The Institute of Optics in the position of Director and Professor of Optics.

4. I have chaired many national and international scientific meetings, including the Ultrafast Phenomena Meeting, CLEO, OSA Annual Meeting, Ultrafast Electronics and Optoelectronics, and the Quantum Optoelectronics Topical Meeting. I am a Fellow of the Optical Society of America and a Fellow and Life Member of the American Physical Society. In 1990, I received the W. O. Baker Award for Initiatives in Research from the National Academy of Sciences, and in 1999 I received the Richtmyer Award from the American Association of Physics Teachers.

5. I have authored over 140 publications and have forty or more patents granted or pending. A list of my publications is included with my curriculum vitae, a copy of which is attached hereto as Exhibit A.

6. I have reviewed U.S. Patent No. 5,818,630 (“the ’630 patent”) and its related prosecution history. I have been asked to provide an opinion as to how one of ordinary skill in the art at the time the ’630 patent was filed would interpret certain language from the claims of that patent. At the time the patent application was filed in June 1997, I would have considered myself to have had at least ordinary skill in the art pertaining to the ’630 patent. Specifically, I have been asked to opine on the meanings of the following four claim terms from Claim 1:

- “mode converter,”
- “converting the mode of the input beam to match a fundamental mode of the multi-mode fiber amplifier,”
- “mode-converted input beam,” and
- “an amplified beam substantially in the fundamental mode.”

A. “Mode Converter”

7. I understand that IMRA has proposed that “mode converter” be construed as “an element capable of matching the mode of a multi-mode amplifier fiber.” This proposed construction is consistent with how a person of ordinary skill in the art, having read the patent, would have interpreted that term in Claim 1 at the time the patent application was filed in June 1997. It is readily apparent to a person of ordinary skill in the art that the ’630 patent describes the recited mode converter broadly as any element that is capable of matching the mode of a multi-mode amplifier fiber. See, for example, Figure 5 and the associated discussion at column 10.

8. I further understand that IPG has proposed that “mode converter” be construed as “an optical imaging system, such as a lens system, a section of tapered fiber, or a combination thereof, capable of matching the mode of the multi-mode fiber amplifier.” IPG’s proposed construction is narrower than the definition a person of ordinary skill in the art would have given that term at the time the patent application was filed in June 1997. IPG’s construction, for

example, requires a “mode converter” to be “an optical imaging system.” A person of ordinary skill in the art reading the ’630 patent at that time it was filed would not interpret “mode converter” that narrowly.

9. IPG’s proposed construction expands on “an optical imaging system” as follows: “such as a lens system, a section of tapered fiber, or a combination thereof.” While I agree that the recited “mode converter” can consist of one or more of the elements listed in IPG’s proposed construction, IPG’s construction is improper to the extent that it is viewed as limiting, rather than as merely exemplary. Indeed, the ’630 patent at column 10 expressly cites such elements as *examples* of mode converters.

B. “Converting the Mode of the Input Beam to Match a Fundamental Mode of the Multi-Mode Fiber Amplifier”

10. I understand that IMRA has proposed that “converting the mode of the input beam to match a fundamental mode of the multi-mode fiber amplifier” in Claim 1 of the ’630 patent does not need to be construed because it should be interpreted to have its plain and ordinary meaning to a person of ordinary skill in the art. I agree that a person of ordinary skill in the art, having read the patent, would have interpreted that claim term to have its plain and ordinary meaning at the time the patent application was filed in June 1997.

11. I understand that IPG has proposed that “converting the mode of the input beam to match a fundamental mode of the multi-mode fiber amplifier” in Claim 1 of the ’630 patent be construed as “converting the mode of the input beam to cause it to match the fundamental mode of the multi-mode fiber amplifier.” I disagree that a person of ordinary skill in the art would interpret this term as IPG has proposed. IPG’s proposed construction adds unnecessary words (the verb phrase “to cause it”) that changes the meaning from the plain and ordinary language recited in the claim itself.

C. “Mode-Converted Input Beam”

12. I understand that IMRA has proposed that “mode-converted input beam” in Claim 1 of the '630 patent does not need to be construed because it should be interpreted to have its plain and ordinary meaning to a person of ordinary skill in the art. I agree that a person of ordinary skill in the art, having read the patent, would have interpreted that claim term to have its plain and ordinary meaning at the time the patent application was filed in June 1997.

13. I understand that IPG has proposed that “mode-converted input beam” in Claim 1 of the '630 patent be construed as “an input beam whose mode has been converted to match a fundamental mode of the multi-mode fiber amplifier.” I disagree that a person of ordinary skill in the art would interpret this claim term as IPG has proposed. IPG’s proposed construction rewords the claim language and adds unnecessary words that changes the meaning from the language recited in the claim itself.

D. “An Amplified Beam Substantially in the Fundamental Mode”

14. I understand that IMRA has proposed that “an amplified beam substantially in the fundamental mode” in Claim 1 of the '630 patent does not need to be construed because it should be interpreted to have its plain and ordinary meaning to a person of ordinary skill in the art. I agree that a person of ordinary skill in the art, having read the patent, would have interpreted that claim term to have its plain and ordinary meaning at the time the patent application was filed in June 1997.

15. I understand that IPG has proposed that “an amplified beam substantially in the fundamental mode” in Claim 1 of the '630 patent means “an amplified beam having substantially all of its energy content in the fundamental mode.” I disagree that a person of ordinary skill in the art would interpret this claim term as IPG has proposed. IPG’s proposed construction rewords the claim language and adds unnecessary words that change the meaning from the

language recited in the claim itself. For example, IPG's definition changes the qualifier "substantially" to the more demanding "substantially all."

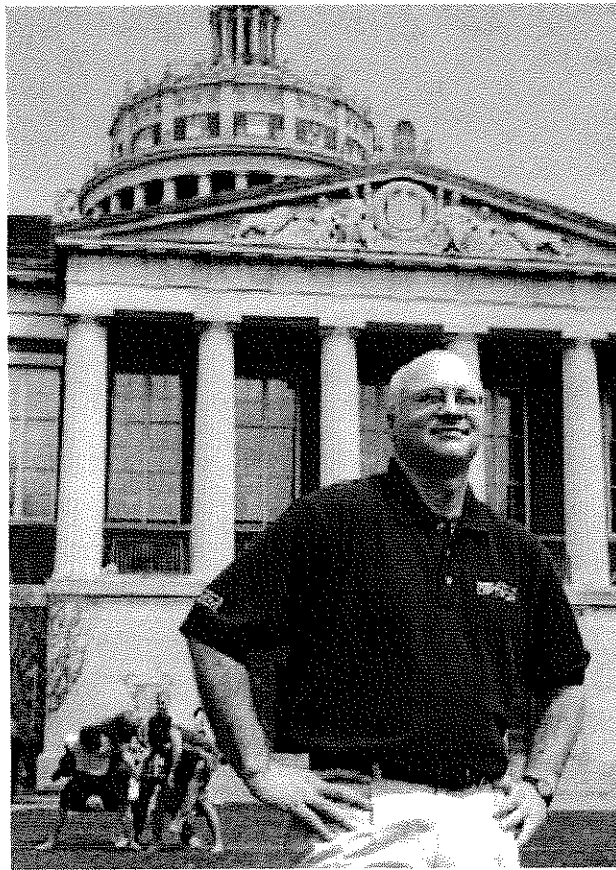
I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct and that I executed this declaration on December 8, 2009, at Rochester, New York.



Wayne H. Knox

EXHIBIT A

Wayne H. Knox



Professor of Optics and Physics

Director of The Institute of Optics – Wilmot 113

University of Rochester

Rochester, NY 14627

585-273-5520

585-273-1072 (fax)

wknox@optics.rochester.edu

Link to Faculty and WHK Consulting web pages: www.whknox.com

update 11/06/09

Wayne H. Knox obtained BS (1979) and PhD degrees (1984) at The Institute of Optics, University of Rochester in Rochester, NY. He went to Bell Labs in Holmdel NJ in 1984 and worked as a Postdoctoral Fellow, was promoted to Member of Technical Staff in 1985 and to Distinguished Member of Technical Staff in 1990. In 1997, he was promoted to Director of the Advanced Photonics Research Department where he was responsible for forward-looking research in a number of areas related to advanced technologies in telecommunications in long-haul, access and Metro networks. He is a Fellow of the Optical Society of America and a Fellow and Life member of the American Physical Society, in 1990 won the National Academy of Sciences W.O. Baker Award for Initiatives in Research. In 1999 he won the Richtmyer Award for Physics teaching from the American Association of Physics Teachers. He has authored over 119 publications and has 39 more patents granted, and has chaired many international professional society meetings such as Ultrafast Phenomena, CLEO, Quantum Optoelectronics, Ultrafast Electronics and Optoelectronics, the OSA Annual Meeting, and Nonlinear Optics. He has served on OSA and APS Fellows committees, and was Chair of the 2002 Tyndall Award Committee. In April 2001 he returned to The Institute of Optics as Director and Professor of Optics where he currently carries out a research program in ultrafast telecommunications and biomedical optics. He was elected to a 2002-2005 term as Director-at-large on the OSA Board of Directors, and served on the Finance Committee. He served on the Scientific Advisory Board of Ardesta and The Science Foundation of Ireland and the Technical Advisory Board for Translume, Inc. He was appointed to the Board of Directors of the Rochester Regional Photonics Cluster in 2002. In 2004, he was awarded the University of Rochester's Robert B. Goergen Award for Excellence in Undergraduate Teaching Artistry. He has served as expert witness in two cases.

Education

Ph.D. Institute of Optics, University of Rochester, 1984

B.S. Institute of Optics, University of Rochester, 1979

Experience

April 2001 – Present : Professor of Optics and Director of The Institute of Optics – University of Rochester, Rochester, NY. Research in ultrafast telecommunications systems and components and ultrafast Biomedical Optics. Teaching : “Optics 101 – Optics in the information Age”

Consulting business : WHK Consulting

Scientific Advisory Board, Translume, Inc., March 2002

Scientific Advisory Board of Science Foundation of Ireland, May 2002

Consultant to technical recruiting firm 2003- present

Consultant on SBIR Phase II in area of solid state ultrafast lasers and amplifiers, 2004

Consultant to company involving femtosecond material processing patents 2004

Technical advisor to FirstWave Technologies – optics business development

Technical advisor to laser energy company 2007-present

Technical advisor to legal firm in technology acquisition 2006

Expert Witness in case Shum-v-Intel for Shum

Expert Witness in case IMRA-v-IPG Photonics for IMRA

Elected to Board of Directors, Optical Society of America 2001-2004, Finance Committee

Board of Directors, Rochester Regional Photonics Cluster, Sept. 2002 - present

1997-April 2001 : Director of Advanced Photonics Research Department, Bell Labs Lucent Technologies in Holmdel, NJ. In this position, I managed a department of 20 people (mostly in Holmdel, some in Murray Hill location) with annual discretionary budget of \$1.5 M in a wide

range of projects from fundamental semiconductor physics and nonlinear optics to WDM (wavelength division multiplexing) systems work. I was responsible for hiring a number of top students, annual performance appraisals of employees, optimizing use of space, and managing special projects funded by business units at up to \$1.1M. Some of the department research programs and technology areas that I managed are: ultrafast technology for UDWDM transmission systems up to 1022 wavelength channels, ultrabroadband WDM pulse sources, WDM interconnects, and ultrahigh speed optoelectronic measurement systems, modelocked fiber soliton lasers, ultrabroadband high power fiber amplifiers, high power diode-pumped solid state modelocked lasers, VCSELs and VCSEL arrays for high density flip-chip bonding to Optoelectronic VLSI for terabit interconnects, 1 and 10 GbE and other applications, MEMS (Micro-electro-mechanical systems) of various varieties principally for wavelength-selective subsystems such as equalizers, add/drop, gain slope compensators, attenuators, etc. These projects resulted in prototype deliveries to Lucent BU customers. Semiconductor growth techniques such as MBE (Molecular Beam Epitaxy), (MOCVD) Metallorganic Chemical Vapor Deposition for VCSELs, modulators, saturable Bragg reflectors, etc. Fiber-wireless advanced systems research and fiber switches.

Research in my Bell Labs department resulted in a number of new activities ranging from creation of new research departments to new business ventures, and several promotions of my people.

Management training

I completed the Executive LEAD Leadership program administered by Manchester Consulting for Lucent Technologies Management including 360 feedback and Briggs-Myers profiling.

1993-1997: **Distinguished Member of Technical Staff**, Advanced Photonics Research Department,
Lucent Technologies, Holmdel, NJ

1985-1993: **Member of Technical Staff**, Optical Physics Research Department, AT&T, Bell
Laboratories, Holmdel, NJ

1984-1985: **Postdoctoral Member of Technical Staff**, Optical Physics Research Department,
AT&T, Bell Laboratories, Holmdel, NJ

4/76-12/83: **Research Assistant**, Laboratory for Laser Energetics
Teaching Assistant, Lasers Lab course and Statistical Optics course (Univ. of Rochester)

1/80-1/82: **Research Assistant**, Xerox Webster Research Lab (1 Day per week)

6/81-7/81: **Visiting Staff Member**, ENSTA Laboratoire d'Optique Appliquee, Plaiseau, France

5/80-6/80: **Visiting Staff Member**, Los Alamos National Laboratory P-Division

Conference Organizing Activities

Ultrafast Electronics and Optoelectronics, 2001 General Chair

Optical Society of America Annual Meeting, 2000 Co-Chair.

Nonlinear Optics, 2000 General Co-Chair

Gordon Conference on Nonlinear Optics Advisory Committee 1995, 1997, 1999

Ultrafast Phenomena meeting Steering Committee, 1998-present.

Conference on Lasers and Electro-Optics, 1999 General Chair.

Ultrafast Electronics and Optoelectronics, 1999 Program Chair.

Conference on Lasers and Electro-Optics, 1997 Program Co-Chair.

Quantum Optoelectronics, 1997 Conference General Co-Chair.

Ultrafast Phenomena, 1996 Conference General Co-Chair.

International Quantum Electronics Conference Ultrafast, 1996 Subcommittee Member

Nonlinear Optics, 1996 Program Committee Member

Quantum Optoelectronics Conference, 1995 Program Co-Chair

Conference on Lasers and Electro-Optics Pacific Rim Ultrafast, 1995 Subcommittee Co-Chair

Ultrafast Phenomena Conference, 1994 Program Co-Chair

CLEO Ultrafast Optics and Optoelectronics, 1993 Subcommittee Chair

Gordon Conference on Nonlinear Optics, 1993 Co-Chair

CLEO Ultrafast Optics and Optoelectronics, 1992 Subcommittee Chair

IQEC Ultrafast Phenomena, 1992 Subcommittee Member

CLEO Ultrafast Optics and Optoelectronics, 1991 Subcommittee Member

Ultrafast Phenomena Conference, 1990 Committee Member

Honors and Fellowships

2004	University of Rochester Robert B. Georgen Undergraduate Teaching Award
1999	AAPT Richtmyer Award
1997-'98	IEEE LEOS Distinguished Lecturer
1996	Fellow of the American Physical Society
1993	Fellow of the Optical Society of America
1990	National Academy of Sciences William O. Baker Award for Initiatives in Research
1987	Citation Classic paper on optical pulse compression to 8 fs
1983	IBM Fellowship
1980-'82	LLE Fellowship
1979	Elected to Tau Beta Pi, Charles L. Newton Prize for Applied Science

Professional Affiliations

American Physical Society (Fellow, Life Member)

Optical Society of America (Fellow)

SPIE (member)

Intellectual Property Management

I have extensive experience with intellectual property generation, IP licensing, nondisclosure, and technology transfer arrangements. One of my patents ('854) has been successfully commercialized under license to Lucent Technologies by a number of large laser companies, and I have been involved in every phase from the original invention to reduction to practice, prototyping, finding customers and negotiating license terms.

Patents Granted

38. *"Performance monitoring in an optical communication system,"* US Patent 7,460,785, M. Dinu, H. Garcia, D. Kilper, W.H. Knox, H. Stuart and C. Xu.
37. *"Method for production of low noise continuum and fiber device for production of low noise continuum,"* US Patent 7403688, W.H. Knox and F. Lu.
36. *"Dynamic measurement of and compensation for impairments to optical data communication pulses using photon-counting silicon avalanche photodiode"* US Patent 7,024,111 W.H. Knox, J. Roth and C. Xu
35. *"Fiber device with high nonlinearity, dispersion control and gain",* US Patent 7,024,078, W.H. Knox
34. *"Optical network using remote optical powering of optoelectronic switch"* US patent 6,567,195, Ford; Joseph Earl; Knox; Wayne Harvey; Krishnamoorthy; Ashok V.; Nuss; Martin C., 2003
33. *"Ultra-fast probe"* US Patent 6,400,165, W.H. Knox and C. Xu, 2002
32. *"Automatic level control circuit for optical system"* US Patent 6,392,769, J.E. Ford and W.H. Knox, 2002

31. *"Article comprising a broad band optical amplifier"* US Patent 6,388,803, W.H. Knox, 2002
30. *"Saturable Bragg reflectors for use in mode-locking lasers"* US Patent 6,259,719, J. E. Cunningham and W.H. Knox, 2002.
29. *"Optical wavelength-space cross-connect switch architecture"* US Patent 6,192,172, M.T. Fatehi and W.H. Knox, 2001.
28. *"Wavelength division multiplexing for unbundling downstream fiber-to-the-home"* US Patent 6,151,144, W.H. Knox, 2000.
27. *"Upgrading a power-splitting passive optical network using optical filtering"* US Patent 6,144,472, W.H. Knox, 2000.
26. *"Modelocking laser including self-tuning intensity-dependent reflector for self-starting and stable operation"* US Patent 6,141,359, J.E. Cunningham and W.H. Knox, 2000.
25. *"High capacity chirped-pulse wavelength-division multiplexed communication method and apparatus"* US Patent 6,141,127, L. Boivin, W.H. Knox; M.C. Nuss, J.B. Stark, 2000.
24. *"Fiber optic network using space and wavelength multiplexed data channel arrays"* US Patent 6,097,519 J.E. Ford, W.H. Knox, A.V. Krishnamoorthy, D.A.B. Miller, M.C. Nuss, 2000.
23. *"Wavelength-selective optical cross-connect"* US Patent 6,067,389, M.T. Fatehi and W.H. Knox, 2000.
22. *"Fiber optic network using space and wavelength multiplexed data channel arrays"* US Patent 6,023,361, J.E. Ford, W.H. Knox, A.V. Krishnamoorthy, D.A.B. Miller, M.C. Nuss, 2000.
21. *"Optical protection switching system"* US Patent 6,016,219, M.T. Fatehi and W.H. Knox, 2000.
20. *"Optical modulator providing independent control of attenuation and spectral tilt"* US Patent 6,002,513, K.T. Goossen and W.H. Knox 1999.
19. *"Loss-less optical cross-connect"* US Patent 5,959,767, M.T. Fatehi and W.H. Knox, 1999.
18. *"Optical switched selector"* US Patent 5,930,013, M.T. Fatehi and W.H. Knox, 1999.
17. *"Fiber Optic Network Using Space and Wavelength Multiplexed Data Channel Arrays"*, U.S. Patent 5,912,751 J.E. Ford, W.H. Knox, A.V. Krishnamoorthy, D.A.B. Miller, M.C. Nuss (2000)
16. *"Optical Protection Switching System"*, U.S. Patent 5,889,610, M.T. Fatehi and W.H. Knox, (2000)
15. *"Optical Switch Distributor"*, U.S. Patent 5,815,613, M.T. Fatehi, W.H. Knox (1998)

14. *"Passive Optical Telecommunication System Employing Multiple Wavelength source and Plural Power Splitting Stages"*, 5,912,749, E.E. Harstead, W.H. Knox, M.C. Nuss and J.B. Stark, (1999)
13. *"Saturable Bragg Reflector Structure and Process for Fabricating the Same"*, US Patent 5,701,327, J.E. Cunningham, W.Y. Jan, W.H. Knox, and S. Tsuda, (1997)
12. *"Chirped-Pulse Multiple Wavelength Communications System"*, U.S. Patent 5,631,758, W.H. Knox and M.C. Nuss, (1997)
11. *"Apparatus and Method for Improving Signal To Noise Ratio In Wavelength Division Multiplexing soliton Transmission systems"*, U.S. Patent 5,726,787, H.A. Haus, W.H. Knox, D.A.B. Miller, (1998)
10. *"Saturable Bragg Reflector"*, U.S. Patent 5,627,854, W.H. Knox, (1997)
9. *"Synchronization of Digital Systems Using Optical Pulses and Optical Modulators"*, U.S. Patent 5,822,106 W.H. Knox and D.A.B. Miller, (1998)
8. *"High-Density Optical Wavelength Division Multiplexing"*, U.S. Patent 5,526,155, W.H. Knox, D.A.B. Miller, M.C. Nuss, (1996)
7. *"Suppressed photocurrent quantum well optical modulation device"*, U.S. Patent 5,436,756, W.H. Knox, J.B. Stark, B. Tell and T.K. Woodward, (1995)
6. *"Free standing quantum well structure"*, U.S. patent 5,383,212, W.H. Knox, S.C. Shunk, M.D. Williams and J.E. Zucker, (1995)
5. *"Ultrashort optical signals generation"*, U.S. Patent 5,265,109, W.H. Knox, (1993)
4. *"Nonlinear external cavity modelocked laser"*, U.S. Patent 5,007,059, U. Keller and W.H. Knox, (1991)
3. *"Optical processing using a multilayer heterostructure"*, U.S. Patent 5,004,325, A.M. Glass, W.H. Knox and D.D. Nolte, (1991)
2. *"Electro-optic apparatus for the measurement of ultrashort electrical signals"*, U.S. Patent 4,978,901, W.H. Knox and D.A.B. Miller, (1990)
1. *"Sweep drive circuit for a streak camera"*, US Patent 4,413,178, G.A. Mourou and W.H. Knox (1983)

Publications in refereed journals

129. Li Ding, Dharmendra Jani, Jeffrey Linhardt, Jay F. Künzler, Siddhesh Pawar, Glen Labenski, Thomas Smith, Wayne H. Knox, "Optimization of femtosecond laser micromachining in hydrogel polymers", JOSA B, Vol. 26, Issue 9, pp. 1679-1687 (2009).
128. Lana J. Nagy, Li Ding, Lisen Xu, Wayne H. Knox, Krystel R. Huxlin, "Enhancement of femtosecond laser intratissue refractive index shaping (IRIS) in the living cornea with sodium fluorescein", accepted in Investigative Ophthalmology & Visual Science (IOVS), April 2009
127. "Fabrication and Characterization of Fused Microfiber Resonators", Parama Pal and Wayne H. Knox, Photonics Technology Letters, vol. 21 issue 12, Page(s): 766-768 (2009).
126. Li Ding, Luiz Gustavo Cancado, Lukas Novotny, Wayne H Knox, Neil Anderson, Dharmendra Jani, Jeffrey Linhardt, Richard I Blackwell, Jay F Kunzler, "Micro-Raman spectroscopy of refractive index microstructures in silicone-based hydrogel polymers created by high-repetition-rate femtosecond laser micromachining," , JOSA B, Vol. 26 Issue 4, pp.595-602 (2009)
125. Parama Pal, Wayne H Knox, "Low loss fusion splicing of micron scale silica fibers", Optics Express, Vol. 16 Issue 15, pp.11568-11573 (2008).
124. Li Ding, Dharmendra Jani, Jeffrey Linhardt, Jay Kunzler, Siddhesh F Pawar, Glen Labenski, Thomas Smith, Wayne H. Knox, "Large enhancement of femtosecond laser micromachining speed in dye-doped hydrogel polymers", Optics Express, Vol. 16 Issue 26, pp.21914-21921 (2008).
123. Li Ding, Wayne H. Knox, Jens Buehren, Lana J Nagy, and Krystel R. Huxlin, "Intra-tissue Refractive Index Shaping (IRIS) of the cornea and lens using a low-pulse-energy femtosecond laser oscillator", Invest. Ophthalmol. Vis. Sci. doi:10.1167/iovs.08-1921 (July 18, 2008)
122. Li Ding, Richard I. Blackwell, Jay F. Kunzler, and Wayne H. Knox, "Femtosecond laser micromachining of waveguides in silicone-based hydrogel polymers," Applied Optics, Vol. 47, Issue 17, pp. 3100-3108 (May 2008) <http://www.opticsinfobase.org/abstract.cfm?URI=ao-47-17-3100>

121. Parama Pal and Wayne H. Knox, "End-sealing short dispersion micromanaged tapered holey fibers by hole-collapsing," *Optics Express*, Vol. 15, Issue 21, pp. 13531-13538 (October 2007)
<http://www.opticsinfobase.org/abstract.cfm?id=142522>

120. Parama Pal, Wayne H. Knox, Ingmar Hartl, and Martin E. Fermann, "Self referenced Yb-fiber-laser frequency comb using a dispersion micromanaged tapered holey fiber", *Optics Express*, Vol. 15, Issue 19, pp. 12161-12166 (September 2007) <http://www.opticsinfobase.org/abstract.cfm?id=141277>

119. Li Ding, Richard Blackwell, Jay F. Kunzler, and Wayne H. Knox, "Large refractive index change in silicone-based and non-silicone-based hydrogel polymers induced by femtosecond laser micro-machining", **Optics Express**, Vol. 14, Issue 24, pp. 11901-11909 (Nov. 2006)

118. Fei Lu, Wayne H. Knox, "Generation, characterization, and application of broadband coherent femtosecond visible pulses in dispersion micromanaged holey fibers," **JOSA B** 23 (6): 1221-1227 June 2006

117. Fei Lu, Wayne Knox, "Low noise wavelength conversion of femtosecond pulses with dispersion micromanaged holey fibers," **Optics Express**, Vol. 13, Issue 20, pp. 8172-8178, (October 2005)
<http://www.opticsinfobase.org/abstract.cfm?URI=oe-13-20-8172>

116. Yujun Deng, Fei Lu, Wayne H. Knox, "Fiber-laser-based difference frequency generation scheme for carrier-envelope-offset phase stabilization applications", **Optics Express**, Vol. 13 Issue 12 Page 4589 (June 2005)
<http://www.opticsinfobase.org/abstract.cfm?id=84336>

115. Yujun Deng, Qiang Lin, Fei Lu, Govind P. Agrawal, Wayne H. Knox, "Broadly tunable femtosecond parametric oscillator using a photonic crystal fiber", **Optics Letters**, Vol. 30 Issue 10 Page 1234 (May 2005)

114. Fei Lu, Yujun Deng, Wayne H. Knox, "Generation of broadband femtosecond visible pulses in dispersion-micromanaged holey fibers", **Optics Letters**, Vol. 30 Issue 12 Page 1566 (June 2005)

113. F. Lu, Q. Lin, Wayne H. Knox, and Govind P. Agrawal "Vector Soliton Fission", **Phys. Rev. Lett.** 93, 183901 (2004)

112. Yujun Deng, Wayne H. Knox, "Self-starting passive harmonic mode-locked femtosecond Yb³⁺-doped fiber laser at 1030 nm", **Optics Letters**, Vol. 29 Issue 18 Page 2121 (September 2004)

111. Fei Lu, Wayne H. Knox, "Generation of a broadband continuum with high spectral coherence in tapered single-mode optical fibers", **Optics Express**, Volume 12, Issue 2, 347-353, January 2004

110. R. P. Prasankumar, Y. Hirakawa, A. M. Kowalevich Jr., F. X. Kaertner, J. G. Fujimoto, and W. H. Knox, "An extended cavity femtosecond Cr:LiSAF laser pumped by low cost diode lasers," **Opt. Express** 11, 1265-1269 (2003), <http://www.opticsexpress.org/abstract.cfm?URI=OPEX-11-11-1265>

109. Lagatsky AA, Leburn CG, Brown CTA, Sibbett W, Knox WH. "Compact self-starting femtosecond Cr⁴⁺:YAG laser diode pumped by a Yb-fiber laser, **Optics Communications**, vol.217, no.1-6, 1 March 2003, pp.363-7. Publisher: Elsevier, Netherlands.

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G. Mourou, W.H. Knox and S. Williamson, "*Advances in picosecond optoelectronics*", **Proc. SPIE** **322**, 107

(1982).

Book chapters

W.H. Knox, "*Ultrafast Science and Technology*", **The New Optics**, Cambridge University Press (in process)

R.S. Knox and W.H. Knox, "*Excitons*", **Encyclopedia of Applied Physics**, Vol. 6, p. 311 (1993).

W.H. Knox, "*Optical Studies of femtosecond carrier thermalization in GaAs*", **Hot Carriers in semiconductor nanostructures**, Ed. J. Shah, Academic Press p. 313 (1992).

Invited, Tutorial and Plenary Conference Presentations

W.H. Knox, "Ultrafast Science and Technology: Twelve Years since the Epiphany," Keynote talk at Photonics North, June 2, 2008.

W.H. Knox, Optics from 3000 B.C. to 3000 A.D., The 2007 Boris Stoicheff Lecture at the University of Toronto, December 2, 2007.

W.H. Knox, "Chirped-pulse Wavelength Division Multiplexing Systems: Inspired by and incorporating Chirped-Pulse Amplification", at **OSA FIO Symposium on the 20th Anniversary of the Chirped-Pulse Amplifier**, October 12, 2006 Rochester, NY.

W.H. Knox, "Growing up" with Lasers - **DLS Banquet talk 2006**, Rochester, New York FIO Meeting

W.H. Knox, "Future Fun with Fantastic Fibers", Plenary talk presented at the **2006 LEOS Summer Topical Meetings**, Quebec City July 17, 2006.

W.H. Knox, "The New Era of Ultrafast Manufacturing", Keynote presentation at the **Annual Lasers and Optoelectronics Marketplace Seminar** at the Fairmont Hotel in San Jose, CA on January 26, 2004, 1:30 pm – 2:10 pm (co-located with Photonics West 2004).

W.H. Knox, "Biomedical Optics Update from Rochester, and How do you make an Ultracompact, Ultrastable, Ultrabroadband, UltrahighPower, UltraLowNoise Optical Source?", **2004 Cross Border Workshop on Laser Science at NRC Ottawa**, Canada, May 7, 2004.

W.H. Knox , "Managing an Optics Career in Turbulent Times", **Education and Training in Optics & Photonics (ETOP) Conference**, October 6-8, 2003 at the Hilton Tucson El Conquistador Golf & Tennis Resort in Tucson, Arizona USA. ETOP 2003 will be collocated with the Frontiers in Optics/Laser Science XIX Conference (pending).

W.H. Knox, "The New Era of Ultrafast Manufacturing", Plenary talk at the **Femtosecond Technology Meeting, Chiba**, Japan, July 16, 2003 <http://www.festa.or.jp/meeting/t-program.html>

W.H. Knox, "*Ultrafast Technology, Commercialization and Education Opportunities*", Plenary talk **OPTO-Canada, May 2002**.

W.H. Knox, "*The Exciting Future of Telecommunications, and prospects for a High Speed Global Digital Divide*", at the **Foreign Policy Institute**, Washington DC (2000).

W.H. Knox, "What can Ultrafast Technology do for Materials Science, and the Reverse", at the **MRS 2000 Meeting**, Boston MA.

W.H. Knox, "*Ultrafast Science and Technology : After the Epiphany*", **CLEO tutorial** (2000).

W.H. Knox "*Radical Optics*" **DARPA April Meeting**, Washington (2000).

W.H. Knox, "*Ultrafast Technology in Telecommunications*", **Tutorial Optical Society Annual Meeting** (1999).

- W.H. Knox, "*Ultrafast Physics in Semiconductors*", **APS Invited Centennial Lecture** (1999).
- W.H. Knox, "*Ultrafast Technology: What can it offer, and is it ready for the real world?*", **MITI FST 98 Workshop**, Tsukuba, Japan (1998).
- W.H. Knox, "*Bringing Ultrafast Technology to the Masses*", **Scottish Universities Summer Schools in Physics**, St. Andrews, Scotland (1998)
- W.H. Knox, "*Ultrafast Technology in Telecommunications*", **CLEO Europe**, Tutorial
- W.H. Knox, "*Ultrafast Epiphany: the rise of ultrafast science and technology in the Real-World*", **Plenary Speaker, Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science**, Anaheim, CA (1996).
- W.H. Knox, "*Ultrafast Optical Power Supplies*", **Conference on Lasers and Electro-Optics**, Tutorial, Baltimore, MD (1995).
- W.H. Knox, "*Transport in GaAs and Si probed with 8fs nonlinear THz spectroscopy*", **Optical Society of America Annual Meeting**, (1995).
- W.H. Knox, "*Dispersion measurement for ultrashort pulse generation and applications*", **Optical Society of America Annual Meeting**, Dallas, TX (1994).
- W.H. Knox, "*What will be the impact of ultrafast science and technology in the realworld?*", **Lasers and Electro- Optics Society Annual Meeting**, Boston, MA (1994).
- W.H. Knox, "*Ultrafast quantum well optoelectronics*", **Lasers and Electro-Optics Society Annual Meeting**, San Jose, CA (1993).
- W.H. Knox, "*Status and limits of femtosecond optics*", **Optical Society of America Annual Meeting** (1992).
- J.B. Stark, W.H. Knox and D.S. Chemla, "*Femtosecond circular dichroism response of quantum well magnetoexcitons from zero to two dimensions*", **International Quantum Electronics Conference**, Vienna, 1992.
- D.S. Chemla, J.B. Stark and W.H. Knox, "*Femtosecond spectroscopy of magnetoexcitons*", **Ultrafast Phenomena VIII Conference**, Antibes, France (1992).
- W.H. Knox, "*Femtosecond spatio-emporal field measurements in GaAs quantum wells*", **Picosecond Electronics and Optoelectronics Conference**, Slat Lake City, UT (1991).

W.H. Knox, "*Ultrafast Dynamical response of quantum well excitons in applied fields*", **Workshop on optical properties of mesoscopic semiconductor structures**, Snowbird, UT, 1991.

W.H. Knox, "*Femtosecond quantum well optoelectronics*", **Gordon Conference on Nonlinear Optics**, Wolfeboro, NH (1991).

W.H. Knox, "*Femtosecond nonlinear excitations in GaAs quantum wells: applied fields*", **XIV International Conference on Coherent and Nonlinear Optics**, Leningrad (1991).

W.H. Knox, "*The revolution in femtosecond near-infrared pulse generation*", **Optical Society of America Annual Meeting**, San Jose, CA (1991).

W.H. Knox, "*Femtosecond real and virtual excitations in GaAs quantum wells: physics and applications*", **4th Binational US/USSR Symposium on optical phenomena and their use as probes of matter**, Irvine, CA (1990).

W.H. Knox, "*Femtosecond excitations in quantum wells in electric and magnetic fields: progress and prospects*", **Walter Schottky Lecture Workshop**, Aachen, Germany (1990).

W.H. Knox, "*Ultrafast lasers and applications in femtosecond quantum well optoelectronics*", **2nd International Forum on the Frontier of Telecommunications**, Tokyo, Japan (1990).

W.H. Knox, "*Femtosecond bandedge excitations in GaAs quantum wells*", **Hot Carriers in Semiconductors 6 Conference**, Scottsdale, AZ (1989).

W.H. Knox, "*Femtosecond sub-bandgap excitations in GaAs quantum wells*", **Quantum Electronics and Laser Science Conference**, Baltimore, MD (1989).

W.H. Knox, "*Femtosecond AC-stark effect in semiconductor quantum wells: extreme high and low intensity limits*", **American Physical Society March meeting**, St. Louis, MO (1989)

W.H. Knox, "*Spectroscopy of nonthermal carrier distributions in semiconductor quantum wells*", **Quantum Wells for Optics and Optoelectronics**, Salt Lake City, UT (1989).

W.H. Knox, "*Femtosecond nonlinear optical response of modulation-doped quantum wells*", **Nonlinear Optical Properties of materials**, Troy, NY (1988).

W.H. Knox, "*Femtosecond real and virtual excitations in GaAs quantum wells*", **4th Brazilian School in Semiconductor Physics**, Belo Horizonte, Brazil (1988).

W.H. Knox, D.S. Chemla, D.A.G. Miller and S.Schmitt-Rink, "*Femtosecond dynamics of non-thermal carrier distributions in GaAs MQWS*", **Nonlinear Optical Excitation Kinetics in Semiconductors**, Bad Stuer, East Germany (1987).

W.K. Knox, "*Femtosecond spectroscopic techniques for kilohertz-rate nonlinear spectroscopy in visible and near infrared spectral ranges*", **International Laser Science III**, Atlantic City, NJ (1987).

W.H. Knox, "*High density excitation of nonthermal carriers in GaAs MQWS*", **Hot Carriers in Semiconductors V**, Boston, MA (1987).

W.H. Knox, "*Techniques of femtosecond pulse generation and applications in spectroscopy*", **American Physical Society Southeastern section annual meeting**, Williamsburg, VA (1986).

W.H. Knox, "*High repetition rate amplification of femtosecond optical pulses: recent developments and applications*", **Optical Society of America Annual Meeting**, Seattle, WA (1986).

W.H. Knox, "*Femtosecond spectroscopic techniques into the single cycle regime and applications in ultrafast dynamical studies*", **Glasgow Symposium on Nonlinear Waveguides and Fast Optical Switching**, Glasgow, Scotland (1985).

W.H. Knox, "*Amplification of femtosecond optical pulses at a 5-10 KHz repetition rate using copper vapor lasers*", **Optical Society of America Annual Meeting**, Washington, DC (1985).

W.H. Knox, "*Picosecond vibrational relaxation dynamics of superoxide ions in alkali halide hosts*", **Enrico Fermi School**, Varenna, Italy (1985).

Contributed Conference Presentations

(too many to list – recent only)

Wayne H. Knox, Li Ding, Dharmendra Jani, Candido Pinto, Jeffrey Linhardt, Jay F. Kunzler, "The Role of Nonlinear Absorption in Enhancement of Efficiency of Femtosecond Micromachining in Hydrogels", Oral presentation at Nonlinear Optics (NLO) conference, NFB7, 2009

Li Ding, Lana J. Nagy, Lisen Xu, Jack Chun-Hung Chang, Jennifer Swanton, Wayne H. Knox, Krystel R. Huxlin, "Enhancement of Intra-tissue Refractive Index Shaping (IRIS) of the cornea by Two-Photon Absorption", Oral presentation at Conference on Lasers and Electro Optics (CLEO), CWE4, 2009

Lana J. Nagy, Li Ding, Lisen Xu, Tracy Bubel, Jennifer Swanton, Wayne H. Knox, Krystel R. Huxlin, "Potentiating femtosecond intra-tissue refractive index shaping (IRIS) in the living cornea with sodium fluorescein doping", Presentation at the annual meeting of the Association for Research in Vision and Ophthalmology (ARVO), paper 568-A538, 2009

Parama Pal and Wayne H. Knox, "Integration of End Sealed Holey Fibers with Dispersion Micromanagement", postdeadline paper at FiO OSA Annual Meeting Rochester, New York, October 2006.

Fei Lu Larry E. Foulkrod and Wayne H. Knox, "Intense Blue Continuum Generation in a short Dispersion-Micromanaged Holey Fiber", Postdeadline paper PD1, Nonlinear Optics Conference 2004, Waikoloa, Hawaii, August 2004.

Optics Express, Vol. 12 Issue 16 Page 3872 (August 2004)

Yujun Deng, Wayne H. Knox, paper CThK2 "Self-starting passive harmonic modelocked femtosecond Yb3+-doped fiber laser at 1030nm" CLEO 2004 Conference, May 2004, San Fransisco, CA.

Fei Lu and Wayne H. Knox, paper JTUB6 "Generation of a broadband continuum with high spectral coherence in tapered single-mode optical fibers", CLEO 2004 Conference , May 2004 San Francisco, CA .

Graduate Student Thesis Supervising

;

Graduated in 2006: Fei Lu, *"Linear and Nonlinear Optical Properties and Applications of Adiabatically Tapered Single-Mode Optical Fibers"*

Graduated in 2006: Yujun Deng, *"Scalable Ultrafast Modelocked Fiber Laser Systems"*,

Li Ding, Graduated in 2009 *"High Repetition Rate Femtosecond Micromachining of Polymers and Biological Materials"*.

Parama Pal, Graduating in 2009 *"Microprocessing of Optics Fibers and Applications"*

Liping Cui, *"Imaging in turbid media using nonlinear absorption"*

Lisen Xu, TBD

Brandon Rodenburg, TBD

Yuhong Yao, TBD

The following students did their PhD or MS research under my supervision in my lab at Bell Labs:

Jeffrey Roth, Princeton University (Ph.D. Student), Faculty Advisor: Keren Bergman (1998 – Present)

Brandon C. Collings, Princeton University (Ph.D. Student), Faculty Advisor: Keren Bergman. Thesis: *“Passive Modelocking of Low Gain Soliton Lasers with A Saturable Bragg Reflector”*, 1999.

Radha Venkat, Princeton University (MS Student), Faculty Advisor : Cliff Fonstad. Thesis: *“Polarization Properties of short-cavity fiber lasers”*, 1998.

Malini Ramaswamy, Massachusetts Institute of Technology, VI-A Fellowship Program Masters student, Faculty Advisor: Cliff Fonstad. Thesis: *“Excitonic electroabsorption spatial field mapping in quantum well devices”*, 1992.

Jason B. Stark, Massachusetts Institute of Technology (Ph.D. student), Faculty Advisor: Peter A. Wolff, Thesis: *“Femtosecond Nonlinear Optical Studies of Magnetoexcitons”*, 1991.

Summer Student Mentoring

Zeyu Zhao, summer 2009

Chun-Hung Chang, summer 2008

Carlin Getliffe, summer 2007

Chun-Hung (Jack) Chang, summer 2007

Larry Foulkrod (REU Student) summer 2004

Nicole Green (REU student) summer 2002

Thomas Olsen (U. Penn) Summer Research Program Student

Melissa Knox (Stanford) Summer Internship Program student

Kathryn D. Li (Stanford) Summer Research Program student

Nathaniel M. Pearson (Rutgers) University Relations student

Jarvis Sulcer (Southern Methodist) Summer Research Program student

Colette A. Sacksteder (Washington State) Summer Research Program student

Noel Thomas (Johns Hopkins) University Relations student

Alanna Dixon (U. of Michigan) Summer Research Program student

Graduate Student Committees

I have been an external member of graduate student committee for PhD students Peter J. DelFyett, CCNY and Hernando Garcia, NJIT.

University Seminars

University of Arizona
Duke University
University of Toronto
MIT
U. Michigan
Williams College
University of Rochester, Dexter Lecture
CREOL – Florida
UCLA
Swarthmore
Columbia University
Cornell University

Alabama A&M
University of Amsterdam – FOM
CEN-Saclay-France
University of Tokyo
University of Florence
University of Pennsylvania
Lehigh University
University of Illinois
Princeton University
Harvard
Rutgers University

Editorships

P.F. Barbara, W.H. Knox, G. Mourou and A.H. Zewail, Editors of Proceedings of Ultrafast Phenomena Conference 1994, Springer-Verlag Series in Chemical Physics, Heidelberg, Helmut Lotsch, Series Editor.

P.F. Barbara, W.H. Knox, J.G. Fujimoto and W. Zinth, Editors of Proceedings of Ultrafast Phenomena Conference 1996, Springer-Verlag Series in Chemical Physics, Heidelberg, Helmut Lotsch, Series Editor.

J.E. Bowers and W.H. Knox, Editors of OSA TOPS volume, proceedings of the 1999 Ultrafast Electronics and Optoelectronics Conference.

Research Interests

Novel telecommunications systems using ultrafast technology, limits of WDM and TDM systems, ultrashort optical pulse generation systems and physics, optical measurement and optoelectronic measurement systems; dispersion measurements and limitation in single-cycle regime; coherence properties of optical fields; physics of semiconductors in quantum-confinement regime; optoelectronic devices and physics of semiconductors in applied fields; biomedical imaging techniques; fiber optic systems; microfibers and microfiber devices; applications of laser technology in environmental, biomedical and industrial process control areas; optics education in general, and in particular with regard to telecom and datacom systems, vision, vision correction and the visual system.

Teaching Experience

University of Rochester, The Institute of Optics, 2002 – present “Optics 101 : Optics in the Information Age”

Drew University: 1987 – 1997; taught 4-week summer course on lasers: theory and applications for the New Jersey Governor’s School in the Sciences.

AAPT: Physics Olympiad Lecturer 1991 – 1997: Laser demonstrations as part of AT&T funded support for training of Physics Olympics Team.

OSA Educators Day: 1991 – Present: teaching high school science teachers how to conduct classroom laser and optics demonstrations.

Other Committees

Chair, OSA/IEEE 2002 Tyndall Award Committee

OSA/IEEE Tyndall Award Committee, 200, 2001

OSA Rapid Action committee on the Annual Meeting, 1999

University of Rochester Laboratory for Laser Energetics Visiting Trustees Committee 1998, 1999, 2000

OSA Leadership Conference, 1999, 2000 Participant

CLEO, Steering Committee (1996)

Ultrafast Phenomena Conference, Steering Committee Member.

Optical Society of America, Fellows and Honorary Members Committee (1995).

Optical Society of America, Member and Education Services Committee (1995-1998)

American Physical Society, Fellows Committee (2000)

Personal

Age 51, married, 6 children.